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ABSTRACT

This combination literature review and guide is designed to provide classroom teachers, administrators, and teacher educators with practical information on the best academic and vocational education integration practices described in the literature. Section 1 examines the rationale for integrating academic and vocational education and summarizes basic integration and teaching practices. Section 2 discusses eight application models and eight curriculum models for integrating academic and vocational education, and Section 3 lists effective strategies and practices. Promising vocational and academic education integration programs, incentives to integration, success factors, and effective instructional materials are discussed in section 4. Section 5 describes and lists contact persons for 32 programs featuring integration strategies that were identified as outstanding in a 1991 publication of the Southern Regional Education Board. Discussed in the final section are the supportive services, staff development activities, and individual vocational instructor and administrator actions needed for improved academic and vocational education integration in the future. Three appendixes provide: a list of six current integration research projects; an outline of "what works in academic and vocational education" (effective curricular strategies, instructional strategies, cooperative efforts, and administrative practices and procedures); and a list of seven selected resources for academic and vocational curriculum integration. (Contains 25 references.) (MN)

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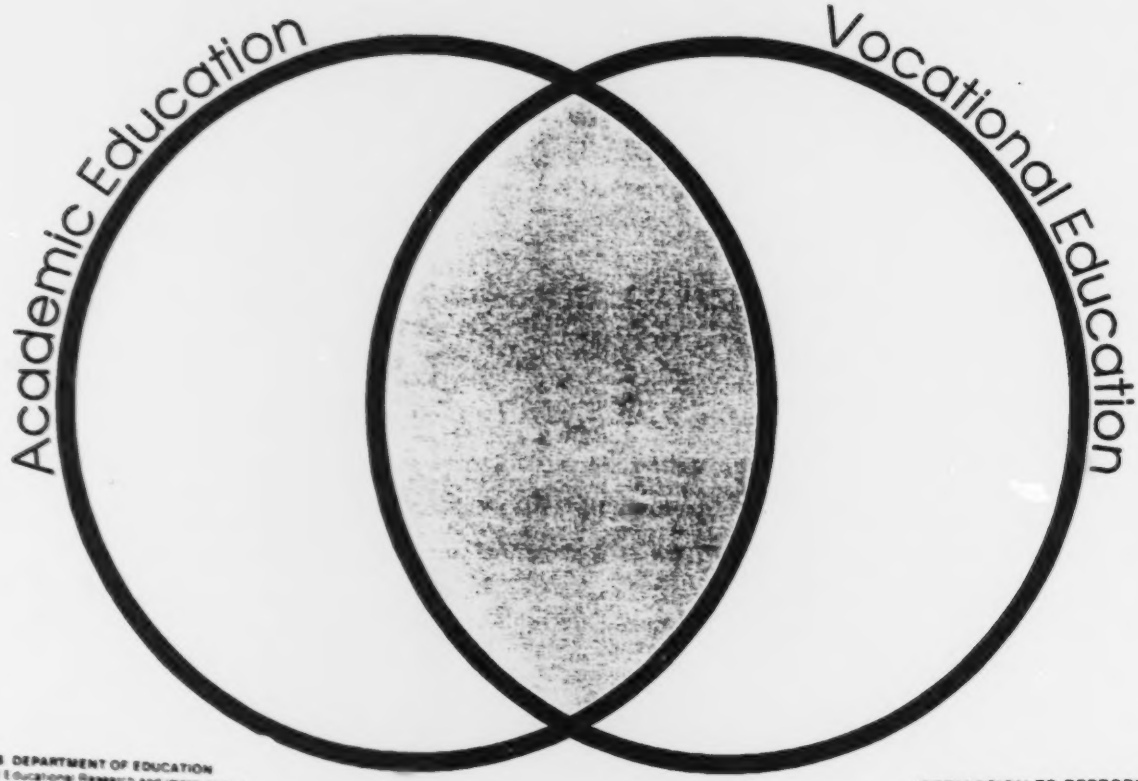
Integrating Academic and Vocational Education

A Literature Review

First In A Series



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Preface

This document is one in a series of related documents on integrating academic and vocational education:

Integrating Academic and VocatiIonal Education -A Literature Review
Integrating Academic and Vocational Education -An Implementation Guide
Integrating Academic and Vocational Education -Best Practices in Florida
Integrating Academic and Vocational Education -Changes in Teacher Education

These documents and two, intensive week long integration institutes were part of a project funded in 1992 by the Division of Vocational, Adult and Community Education through the University of South Florida, The University of West Florida, and The University of Central Florida.

Integrating Academic and Vocational Education -A Literature Review is a product of faith in cooperative planning and teamwork. This document was designed with the classroom teacher, administrator and teacher educator in mind. Our goal was to provide the reader with a practical document that describes the "best practices" in the literature in a manner that practitioners can use to improve their schools, programs, and teachers.

Collaboration among teacher educators from The University of West Florida, The University of South Florida, and The University of Central Florida dedicated to providing leadership and modeling of teamwork has contributed to the development of this document. Dr. Bill Blank, The University of South Florida and Dr. Steve Sorg, The University of Central Florida, provided encouragement and major contributions in it's design and organization.

A team of researchers and writers including a classroom teacher, academic teacher educators, and vocational teacher educators worked diligently in the development of this document. We sincerely appreciate the following individuals for their intensive contributions, writing, and editing:

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The other members of The University of West Florida's Academic and Vocational Teacher Education Team, who continue to work cooperatively together for the future of education, are recognized for their inspiration and faith:

Mrs. Alice Guidy, Vocational Director, Santa Rosa County School District
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Dr. James Parker, Academic Teacher Educator
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On behalf of those who have been involved in this project, we appreciate the opportunity to develop ***Integrating Academic and Vocational Education — A Literature Review.***

Wally S. Holmes, Ph.D.
The University of West Florida

Integrating Academic and Vocational Education

Rationale for Integrating Academic and Vocational Education

Integration and Teaching Practices

Integrating Academic and Vocational Education

Change must take place in American schools! The literature abounds with this theme. More and more, educational thinkers are sounding their concern for our nation's economic plight and the role that education plays in causing and relieving this plight. In the October 1992 issue of the *Vocational Education Journal*, William Brock, Chairman of the Secretary's Commission on Achieving Necessary Skills (SCANS) offered a critical analysis of the nature of our predicament: "Historically, our schools have played a critical role in the success of this nation. In the last 20 years, however, America's social and economic foundations have been eroded by a rising tide of educational mediocrity that threatens all of us, putting this land on a downward path toward low skills, low productivity and low wages. In a real sense, we are failing our children, short-changing their future and ours." (p. 20) The Southern Regional Education Board (SREB), documented this erosion when they reported that employer surveys indicate that high school students joining the workforce are poorly prepared and do not have the academic and problem-solving skills required to succeed in the workforce of today (SREB, 1991). Certainly, the future health of the American economic system will depend upon our ability to better match the skills and knowledge of the workforce with the requirements of the workplace.

Workplace know-how has been described by SCANS as demanding strength in five competency areas—the effective use of resources, interpersonal skills, information, systems, and technology, and three foundation skill areas—basic skills, thinking skills, and personal quality skills (Secretary's Commission on Achieving Necessary Skills, 1991).

The demands on business and workers are different today. To be competitive, American firms must meet world class standards and so must American workers. Employers seek employees who are adaptable and have the ability to learn and work in teams (Brock, 1992). Keeping a competitive edge will depend upon a workforce that can cooperatively define problems, make adjustments, and, if necessary, change directions rapidly.

A time of crisis is upon us as massive as any we have ever faced. Historically, American education has risen to the call during times of crisis by producing a bigger and better workforce to fire the engines of industry. Our current economic course has as great a potential to destroy the American dream as any Kaiser, Hitler, or Stalin, but our economic crisis demands a different kind of response, a

different kind of workforce. The workforce needed to win the economic battle must work more efficiently, smarter. The question facing us is not so much, "Can our education system meet this new crisis?" as "Can the American dream survive if the education system cannot meet the crisis?" Sadly, we must respond during a time when the American education system is viewed more as a cause of the problem rather than a solution. "If public education is to survive as a vital force in American life, there must be a reformulation of the school's purpose,"—a purpose "that will lead to a vision which will enhance and empower students..." (Schlechty, 1990, p. 31).

One of the major changes underway in our educational system which holds great promise for addressing many of the problems cited earlier is the integration of academic and vocational education. Although it won't solve all the problems facing education today, the integration movement promises to make academic learning more job relevant and more applied while emphasizing the academic rigor of vocational programs.

Even congress has mandated that change such as integration take place. The passage of the Carl D. Perkins Act in 1984 and the 1990 Perkins Amendments specifically address the changes that must be made in vocational education. The 1990 Amendments tie federal funding to efforts to integrate vocational education and academic education. The 1990 legislation states that funds shall be used to provide vocational education in programs that integrate academic and vocational education. In such vocational programs, coherent sequences of courses are required so that students achieve both academic and occupational competencies. The mandate is clear: We must produce a smarter workforce. The integration of academic and vocational education is one promising strategy for doing that.

Rationale for Integrating Academic and Vocational Education

The need to integrate academic and vocational education is well documented in the literature. The way teaching and learning is now taking place in schools is clearly not preparing students for daily life and work. Resnick (cited in Aldeman, 1989) refers to four major problem areas:

1. In school, learning and assessment of what has been learned are almost exclusively individual activities. Outside of school, most activity is socially shared and a "success" is the result of group effort.

2. In school, the bottom line is what students are able to do unaided by external supports of "tools" (e.g., books, notes, calculators, etc.). In contrast, the use of tools is encouraged or even required in the world of work to increase both efficiency and accuracy.

3. School learning is largely symbol-based and far removed from any connection to real objects, or real problems. Concrete problems must be solved many times using paper exercises. Research indicates that in the real world, people routinely solve concrete problems easily and accurately that would stump them as paper exercises.

4. The schools' mandate is to teach broadly applicable skills and theoretical principles that are presumed to be transferable. However, evidence is accumulating that the skills learned in school have limited transferability to specific situations outside of school.

These points are simple, but profound. They help to identify why our current educational system does not produce an individual equipped with the competencies, skills and qualities necessary to succeed in today's complex workforce. As Pritz (1991) states, "Human productivity depends on what we do with what we know". As we examine these four "gaps" we can easily see a problem—students are not able to apply their knowledge, and "learners who know and can't do will be equally at risk in our future world with those who try to do without knowing" (p. 3).

When schools produce graduates who cannot effectively function in today's business environments, the cost of industry training and retraining is tremendous. In 1989, a study by the American Society of Training and Development (ASTD)

focused on the purposes for which business and industry training dollars were most consistently spent. ASTD found that companies were extensively training employees in problem-solving and teamwork, interpersonal skills, writing, oral communication, goal setting and listening (cited in Scaglione, 1992). These are all major outcomes assigned to the public schools.

Integration and Teaching Practices

Norton et al., (1986) state that students are seldom provided opportunities to see the connection between the subject being studied and its utility beyond the school setting. Nor are they required to actually use their knowledge of competencies to address problems in the world beyond. They believe that problems can partially be solved by integrating academic and vocational education. Course content is also a reflection of expectations for students.

Scaglione (1992) suggests that business educators need to look again at the methods used in the classroom and focus on teamwork and cooperative strategies. Norton, King-Fitch, and Harrington (1986) also believe that successfully closing the gap between academic and vocational courses of study in secondary schools means combining academic and vocational content and instructional methods in a way that improves students' proficiency and maximizes their potential for future learning and advancement. One new purpose for vocational education should be to clarify the relationship between vocational and academic education.

A properly designed vocational curriculum provides the real-life experiences that enable many students to learn and retain basic and advanced-level competencies through an applied approach. Many academic educators fail to recognize that by focusing academic studies around a student's prospective vocational interest, the usefulness and purpose of academic knowledge at long last becomes clear. On the other hand, many vocational teachers fail to realize that students will learn more technical knowledge and skills if they are encouraged to improve their reading, mathematics, and science competencies in the context of their vocational studies.

Claus (1989) presents much the same view in the following recommendations he makes for vocational classrooms: "...problem-solving, decision making, and analytical thinking should be made an explicit part of instruction. The role of the teacher is to guide students in their experiential activities toward analysis, generalization, and purposeful application of what has been learned" (p. 196). Experiential learning is recognized for combining problem solving or inquiry with guided, reflective discussion for the purpose of developing knowledge and skills

that can be meaningfully applied in new situations. Vocational educators need to work to restructure instruction for the purpose of focusing on the process of problem solving and reflective analysis. Vocational students need to be taught the techniques of inquiry, and they should be required to use and demonstrate them. The integration of academic and vocational education can provide the framework within which today's students can master the skills needed to succeed in the workplace of tomorrow.

Grubb (1991) states that vocational education must have a broader purpose and focus in the future. Vocational education will serve as a delivery system in which various subject areas will blend and interrelate into an integrated and comprehensive education program that emphasizes higher order thinking and problem solving skills. By utilizing a variety of approaches, such as cooperative learning, applied instructional strategies, problem solving and experimentation, this new integrated instructional system will help students learn how to learn.

Models of Integrating Academic and Vocational Education

Application Models

Curriculum Models

Models of Integrating Academic and Vocational Education

Let's examine several "models" or approaches to the integration of academic and vocational education. One set of models (application models) will focus on how integration is applied to schools, programs and courses while the second set of models deals with how integration impacts curriculum (curriculum models).

Application Models

Several major application models of academic and vocational education integration have been identified in the literature (Stasz & Grubb, 1991):

1. Incorporating more academic competencies (including basic skills) into vocational courses.

2. Combining academic and vocational teachers to enhance academic content in vocational programs.

3. Making academic courses more applied or relevant, e.g., "applied academics" and other interdisciplinary courses.

4. Curriculum alignment: modifying both academic and vocational courses through both horizontal (coordinating) alignment of courses and "vertical" (sequencing) alignment of courses.

5. The senior project as a method of integration.

6. The Academy model -- schools-within-a-school.

7. Occupational high schools and magnet schools.

8. Occupational clusters, "career paths", and occupational majors.

As a teacher or administrator, it is easier to evaluate the models according to the change that would take place throughout the school. On pages 12 and 13, these eight models are shown in table form to emphasize which students are targeted for each model and the various curriculum changes, teacher changes and institutional changes that would occur when implementation takes place.

Curriculum Models

Robin Fogarty (1991) describes a range of curricular models for developing integrated instruction. Eight of the models provide promise in a plan to merge or integrate academic and vocational subject matter. Each of the following models will be briefly described followed by an example of how it could be applied.

Nested Model

Within each subject area, the teacher targets multiple skills: thinking, social, and content; it is a multiple dimensional approach to one topic or unit. Example of nested model: A high school computer science class that targets the CAD/CAM programs. Thinking skills requiring "envisioning" are required for explicit exploration and practice as well as practical skills required to operate the program are emphasized. In this approach, students may also be instructed in ergonomics as they design furniture for schools of the future.

Sequenced Model

Topics or units are taught separately. However, they are rearranged and sequenced to provide a broad framework for related concepts. The synchronized study of the stock market in math, the depression in history, and investments in business provide examples of the sequenced model.

Shared Model

This model brings two distinct disciplines together into a single focused image with shared planning, teaching or both in the two disciplines. Examples of the shared models: The Applied Communications and Business Education team members may examine key concepts, skills, and attitudes typically taught in their single-subject approach. They could modify the curriculum to provide overlaps in the curriculum, joint projects and commonalities for the students.

Webbed Model

Typically a theme is used to integrate subject matter. Once a cross-departmental team has chosen a theme, the members use it to overlay and pull in the different subjects and activities. The possibilities for curricular webbing can be categorized as concepts, (e.g., change, freedom, cooperation), topics, (e.g., relationships, partnerships, business) or categories, (e.g., careers, biographies, personalities).

Application Models of Integrating Vocational and Academic Education

	Curriculum Changes	Teacher Changes	Students Targeted	Institutional Changes
1. Incorporating more academic content in vocational courses	Vocational courses include more academic content	Vocational teachers modify courses	Vocational students	None
2. Combining academic and vocational teachers to enhance academic content in vocational programs	Vocational programs include more academic content in either vocational courses or related applied courses	Academic teachers cooperate with vocational teachers	Vocational students	None
3. Making academic courses more vocationally relevant courses (e.g., applied academics) adopted	Academic courses include more vocational content; sometimes new	Academic teachers (usually) modify courses, or adopt new ones students	Potentially all students; in practice, vocational and general-track	None
4. Curricular alignment: horizontal and vertical	Both academic and vocational courses modified, and coordinated across courses and/or over time	Academic and vocational teachers cooperate; numbers range from two to all	Potentially all students; actual targets vary	None necessary. Curriculum teams may foster cooperation.

	Curriculum Changes	Teacher Changes	Students Targeted	Institutional Changes
5. Senior projects	Seniors replace electives with a project; earlier courses may change in preparation prepare students	None necessary; teachers may develop new courses or modify content to better	All students	None necessary
6. The Academy model	Alignment among Academy courses (English, math, science, vocational) may take place	Academic and vocational teachers may collaborate on both curriculum and students areas	Usually potential drop-outs; sometimes students interested in specific occupational	School-within-a school, block rostering; smaller classes; links to employers
7. Occupational high schools and magnet schools	Alignment among all courses may take place, emphasizing occupational area	All vocational and academic teachers assigned to an occupational focus or magnet within a school; collaboration facilitated	Students interested in specific occupational areas	Creation of a self-contained occupational or magnet school
8. Occupational clusters, "career paths," and majors	Coherent sequences of courses created; alignment may take place among courses	Teachers belong to occupational clusters rather than (or in addition to) conventional depts.; collaboration facilitated	All students	Creation of occupational clusters; enhance-ment of career counseling; possible cluster activities.

Grubb et al., 1991

Threaded Model

A metacurricular approach to content is utilized in which the "big ideas" are enlarged throughout all content. This approach pulls thinking skills, social skills, study skills, technology, and a multiple intelligences approach to learning throughout all disciplines. Using the threaded model, the curriculum team might choose to infuse the skill of analysis into each content area. Examples of questions that the teacher could ask students to reinforce the threaded process are: "How did you think about that? What thinking did you find most helpful? How well did your group work today?" These are in contrast to the processing question with the typical cognitive question, "What answer did you get?"

Integrated Model

This model uses a cross-disciplinary approach overlapping skills, concepts, and attitudes in as many as four major areas. In the elementary classroom, utilization of the whole language strategy provides an example of the model; activities related to writing or reading across the curriculum at the secondary level provide examples of the integrated model.

Immersed Model

This model filters all content through an area of interest and expertise. The integration takes place within the learners. For example, an immersed learner might say that everything learned related to their interest is a "labor of love". The artist who draws sketches for mind maps of concepts in learning is constantly making connections to the subject of art.

Networked Model

This model allows the learner to guide the direction of the integration of subjects. The learners reach out across disciplines for the resources to meet their goals. The comprehensive competitive events and written projects within the marketing and business curriculum allow for many opportunities to implement the networked model at the secondary and post-secondary levels.

The application models and the curriculum models are both presented in Figure 1 to illustrate where the application model might be used as a method to implement the integrated curriculum.

Figure 1

Application and Curriculum Models

Curriculum

Application	Nested	Sequenced	Shared	Webbed	Threaded	Integrated	Immersed	Networked
1. More AC content in VOC courses	X		X	X	X	X		X
2. Combining AC/VOC teachers to enhance AC content in VOC courses	X		X	X	X	X		
3. Making AC courses more VOC relevant			X	X	X	X		X
4. Curricular alignment horizontal and vertical		X			X	X		
5. Senior Project	X			X	X			X
6. The Academy	X	X	X			X		X
7. Creation of a self-contained occupational school							X	
8. Occupational clusters, "career paths" & major clusters, enhance-ment of career counseling		X		X			X	X

Strategies and Practices for Integrating Academic and Vocational Education

Strategies

Practices

Joint Efforts

Tech Prep

Other Methods

Strategies and Practices for Integrating Academic and Vocational Education

The case for integrating academic and vocational education is very strong. *Florida's Blueprint for Career Preparation* states that "schools must completely integrate academic and vocational education if they are to successfully prepare students for life in the information age" (Florida Department of Education, 1991, p. 11). The *Blueprint* suggests that curriculum and instructional strategies should be developed for both academic and vocational teachers and that they include the following:

- Teaching academic content through applied science, mathematics and communication courses;
- Infusing applied teaching methods into existing science, mathematics and communications courses;
- Coordinating the teaching of vocational and academic instruction;
- Revising vocational curriculum and instruction so that greater emphasis is placed on the mathematics, sciences, communications and technical concepts and skills that underlie the competencies of an occupational area.

Strategies

In the October, 1992 *Professional Development Bulletin* from the National Center for Research in Vocational Education, seventeen strategies were recommended for integrating academic and vocational education:

- Seek support of the entire school staff for the goals of integration projects and include vocational and academic teachers as well as counselors in all stages.
- Publicize to students, parents, and community the purposes and anticipated outcomes of integration.

- Provide for extensive staff development, including workshops with clearly defined outcome goals.
- Seek funds for release time, equipment, and materials from federal and state grants and local businesses.
- Work cooperatively with local postsecondary institutions to provide staff development at a reasonable cost.
- Commit time to discussions between vocational and academic teachers about their own subject matter in order to find matching complementary objectives;
- Involve teams of teachers, counselors, and business persons in reviewing and developing the curriculum and materials.
- Send groups of vocational and academic teachers to observe how the skills they teach are applied in the local workplace.
- Let teachers risk trying new ideas even though results are not guaranteed.
- Operate summer retreats where groups of vocational and academic teachers share their experiences and devise possible ways of collaborating during the coming year.
- Provide release time and travel funds for academic and vocational teachers to visit school sites and interact with teachers and counselors who have already begun to integrate academic and vocational education.
- Consider a teacher-selected, problem-focused curriculum dealing with real-work problems that need solutions.
- Facilitate collaborative planning and teaching efforts by arranging schedules to ensure the flexibility of the teachers. Reducing the isolation of teachers seems to make them more enthusiastic about what they are doing; they understand the connections among courses better; and there is a common enterprise in shaping the education of young people.

- Provide a professional reference library on the subject of integrating academic and vocational education, tech prep, teacher collaboration, and other pertinent topics.

- Utilize student projects and portfolios to reinforce academic and vocational concepts.

- Sequence academic and vocational courses back-to-back so that students have sufficient time in classroom and laboratory experiences to see the parallels between the subject matter and to become engaged in activities of sufficient time and depth to facilitate integrated teaching and learning.

- Mix students from different curriculum areas and move students to new areas of the building to overcome the limitations of tracking. Students may become more enthusiastic, make better connections between subjects, and discover practical benefits for life beyond school (NCRVE, 1992).

Practices

In addition to the research being conducted by the NCRVE, the Southern Regional Education Board (SREB) has encouraged academic and vocational integration. One of the most widespread efforts to strengthen the basic skills of vocational education students is the SREB-State Vocational Education Consortium. The purpose of the SREB consortium is to advance, apply, and evaluate approaches that will strengthen the development of the basic competencies of students enrolled in vocational programs.

The nineteen member states of the SREB-State Vocational Education Consortium are committed to achieving the integration of vocational and academic education. This is being done through a pilot program called "High Schools That Work." The National Center for Research in Vocational Education is also a partner in this effort.

Plans call for the implementation of the program in 300 schools by the end of the 1993-94 school year. According to the SREB, "The outcome goal of integration is to improve the reading, mathematics, science, technical, and problem-solving competencies of the students completing a major in vocational studies" (Bottoms & Presson, 1992, pp.1-2). The SREB has developed an integration model that involves implementing nine key practices that provide a framework for making the high schools work for students with vocational majors:

- Establishing higher expectations of students in both academic and vocational classes;
- Revising vocational programs to reinforce higher order concepts in communications, mathematics, and science;
- Revising academic courses to teach essential concepts from the college preparatory curriculum through an applied process;
- Requiring students with vocational majors to complete three courses each in mathematics and science, with at least two credits in each area being equivalent in content to courses offered in a college preparatory program, and to complete at least four courses in a vocational major and two related courses;
- Encouraging vocational and academic teachers to work together in preparing students for continued learning on the job or in school;
- Revising the instructional process so the student is a worker and is actively engaged in the learning process;
- Providing guidance and counseling services that help students plan and pursue a more challenging program of studies and that involve parents in the process;
- Providing extra help that will enable students to complete successfully a program of study that includes higher level academic content; and
- Participating in and using student and program assessment information to check and improve curriculum, instruction, school climate, and school organization and management.

The SREB and its consortium partners believe that to significantly improve achievement of vocational completers, any model for integrating academic and vocational studies must change the high school's focus from **ability** as the key to success to **effort** as the key. The nine key practices have the potential for doing this for students striving to complete a vocational major by changing:

- What is expected;

- What is taught;
- How it is taught;
- How teachers relate to students, how academic and vocational teachers relate to each other, and how the school relates to parents; and
- How the school uses data for measuring their successes with vocational completers.

This integration model raises expectations. It enables the high school to replace a system that has expected only some students to master the basic college preparatory academic courses with one that expects all students to master that content. "A high school's expectation of students taking a vocational major is a significant factor in determining their achievement level in reading, math, and science" (Bottoms & Presson, 1992, pp. 2-3).

Successful practices for integrating academic and vocational education have been grouped by the Northwest Regional Education Laboratory (NWREL) into five categories:

1. in a single class;
2. between two classes;
3. across a school;
4. beyond the school;
5. at the state level.

The examples of what works in each of the practices can be identified from case studies throughout most of the nation (Owens & McClure, 1989).

In a Single Class

- In an algebra class, the teacher uses Ohm's law as an example of occupational relevance.
- In a language arts class, the teacher asks students to role play a given "roadblock" to communication, using their work experience or personal experiences.

Between Classes

- Vocational teachers make up a weekly list of occupational terms that students must learn to use and spell correctly in their English class.

- In electronics class, juniors study direct circuits, while in science, they analyze electric motors.

- Science and vocational education teachers work together to develop and operate an environmental science class in a 40 acre woodland nature preserve. Among other things, students construct salmonoid egg-hatching boxes and establish a migratory fish run in a local stream. Biology and botany classes identify trees and plants which woodworking and metals classes mark with specially designed plaques.

School Level

- Academic and vocational teachers set up a school-wide problem-solving program for students and a file of problem-solving exercises for teachers in the staff resource center.

- Vocational teachers conduct several informal evening classes for other teachers who want to learn more about specific vocational areas.

Beyond the School

- Seniors interested in learning technical math receive instruction from their vocational-technical teachers. The vocational teachers invite local technical college instructors to consult with them and their classes.

- As one way of gaining first-hand experience in writing, students in a cooperative office education program interview secretaries or general office workers and request sample letters and memos to review.

- Students enhance basic math skills by preparing a monthly budget to determine how much money they need to make in their entry-level positions to become self-supporting and live independently. Business leaders and professionals in the community are asked to provide information about prices.

State Level

- Interagency articulation seminars initiated by key staff from the State Department of Education and the State Division of Vocational Education in Idaho planned and initiated a statewide Basic Skills Project in 10 districts.

- A one week Linear Measurement Unit, developed by the Basic Skills Project in Idaho, has been distributed to all trade and industry instructors in the state, as well as to all Basic Skills team members in 10 districts.

Joint Efforts

In the educational excellence movement, the following assumptions have contributed to the "joint efforts approach" to incorporating basic skills into the vocational curriculum: academic skills are embedded in vocational education; vocational tasks provide for realistic use of academic basic skills (e.g., connecting academic learning with application strengthens students' basic skills) and neither academic skills nor vocational skills should be taught in isolation from each other.

According to Stasz and Grubb (1991), aggressive integration to date seems to include at least one of the following elements:

- curricular (horizontal or vertical) alignment, which modifies both academic and vocational courses

- changes in pedagogy

- organizational structure changes such as occupational clusters, academies and "block" classes

Vocational and academic teachers who desire to develop an integrated and articulated program have typically utilized one of three main options: sharing, teaming, and crossing over (from vocational to academic education or vice-versa). These options can be used in all types of programs, including traditional vocational programs, compensatory and support-oriented programs, and alternative programs. Practices that have been found to work well include student learning contracts, visiting consultants or specialists, cooperative programs, competency-based education, applied learning in a problem-solving mode, and Academic Development Plans (ADPs).

An ADP describes a student's present level of educational performance, states annual goals, and identifies appropriate objective criteria, evaluation procedures, and schedules for determining whether or not these objectives are being achieved. The ADP is developed by a team of academic and vocational instructors. An Individualized Education Plan (IEP) is similar to an ADP; however, it is usually developed by a group of individuals to assist a student with special needs. The group includes academic and vocational instructors as well as a parent, the student, and possibly a psychologist. Other cooperatively developed plans include the Individualized Training Plan (ITP) and the Individualized Career Plan (ICP). Each of these plans lends itself to coordination by a team of academic and vocational teachers and business or guidance representatives.

The joint strategies for vocational and academic teachers may be accomplished in a number of ways (Pritz & Crowe, 1987):

- Sharing: This includes the program planning process, instructional materials selection and development, teacher preparation process (both in-service and pre-service), and program implementation process.

- Teaming: at any stage throughout the program design / development / evaluation cycle, in regular or periodic team teaching arrangement; concurrent examples include working cooperatively in the same classroom at any given time; alternate examples include switching class groups for emphasis of specific concepts or experiences.

- Staff Crossover: Teachers exchange roles with each other. Examples include developing cooperatively evaluated projects with academic and vocational emphasis such as a report which is graded for content by the vocational instructor and for structure by the English instructor. Other examples of staff crossover include attending classes in each other's course in an auditing capacity, assisting in the actual analysis of each other's classes and instruction.

Tech Prep

Tech Prep is a term that has been coined to refer to an articulated sequence of study beginning at the secondary level and continuing through at least two years of post-secondary vocational education. The term "Tech" refers to technical occupations that meet the following characteristics (Hindman, 1992):

- In high demand,
- Lead to higher-paying positions requiring increasingly complex academic and vocational-technical skills,
- Involve the use of new and emerging technologies such as computer applications,
- Require additional education and training after high school,
- Will require a lifetime of continued updating and retraining for continued success and advancement.

The Federal Carl Perkins legislation authorizes all traditional vocational program areas for potential Tech Prep development.

Tech Prep associate degrees (TPAD) offer students an opportunity for educational excellence when the programs emphasize the five "C's" identified by Hull and Parnell (1991):

- Continuity in learning
- Context-based teaching, i.e. applied academics
- Competency-based teaching/learning
- Communication between learning institutions (beyond articulation)
- Completion of the program wih an associate degree

Development of TPAD's is seen as a "Win/Win" situation for all stakeholders in education. While the majority of Tech Prep models are designed for the secondary student to articulate to the post secondary institution, many models have been piloted for adults and are described by Hull and Parnell in their 1991 edition of *Tech Prep Associate Degree--A Win/Win Experience*.

A TPAD consortium is a local network of organizations and individuals that are committed to making the changes in the local education system required to improve the educational and career opportunities of students and provide employeers with world-class workers. As of 1992-93 Florida has formed 17 Tech

Prep Consortia. Some of the areas of technical education emphasis in the Florida consortia include allied health, agribusiness, industrial, marketing, nursing, business, computer science, telecommunication, engineering, biomedical electronics, desk-top publishing, environmental science, automobile service management technology, and many others.

Utilizing applied academics is typically an educational strategy which provides the teaching of academic foundations courses in a vocational setting. The strategy of integrating applied academics into a TPAD program provides opportunities for a stronger foundational core of academic competencies.

Implementation of a Tech Prep Program is highly dependent on teamwork, commitment to change, identifying issues and overcoming barriers, involement of both school and local stakeholders in the program, and connecting students to the marketplace through mentoring and employment. The National Tech Prep Network provides many services and products for individuals and entities looking at Tech Prep as a strategy for integating academic and vocational education. The organization is supported by CORD. The phone number and address of the organization is found in Appendix C.

Other Methods

One of the methods of instruction often found in the vocational classroom is competency-based education (CBE). The process is based on the principle of analyzing complex skills, breaking them down into their component tasks, and then teaching them in a logically designed series of performance objectives. The format may be used in an individualized, self-paced manner or in a joint teaching format with any combination of efforts included teachers sharing, teaming, or crossing over. Another strategy with particular promise is applied learning in a problem-solving mode. This approach is based on the principle that problem-solving and decision-making processes and competencies are embedded in the activities; activities are participatory and related to the real world and real consequences; and reinforcement of basic skills information needed is provided with a suitable amount of guidance on how to proceed (Pritz and Crowe, 1987).

Veach and Crowe (1987) collected 47 exemplary basic skills techniques and 24 exemplary joint effort techniques that have proven effective in the various arrangements (sharing, teaming, and crossing over) to helping reinforce basic skills for vocational students.

BASICS: Bridging Vocational and Academic Skills, A Guide to Implementing Academic and Vocational Education, is an integrated package which includes research findings, teaching techniques, instructional materials, strategies, and support roles (NCRVE, 1988). The package has been successfully used by many groups to facilitate change. The New-Bern Craven County Schools in New Bern, North Carolina described their success and the results of implementing *BASICS* in their schools. The major approach taken at the middle school level was to develop interdisciplinary teams for planning and teaching purposes. Teams were given daily common planning periods. Ideally the teams focused on curriculum development necessary for integration. The results of the activities culminated in an *Integrated Middle Grades Curriculum Guide*. The program works because there has been support from both administration and the instructional staff. In addition, early staff development allowed teachers to identify a number of high priority concerns, i.e. cohesion of academic and vocational education, relevance, credit flexibility, dropout prevention, etc. Teachers worked on action plans and met with administrators. Academic teachers spent a full day rotating throughout vocational programs as if they were students. Vocational teachers visited academic classes in return. They also jointly visited local business and industry sites to document what they saw and to talk about how it might fit into their integration program and curriculum (Pritz & Davis, 1990).

Suggestions from business and industry of what teachers can do to help the workers of the future to meet companies' basic skill needs include the following (Saglione, 1992):

- motivate students to study basic skills by providing application opportunities;
- encourage good study habits;
- recognize skills achievement;
- develop long-term, informal relationships with employers, improve student records, and collaborate with other teachers, counselors, and school specialists as well as business.

Examples of What Works in Academic and Vocational Integration

Cases with Promise

Incentives

Success Factors

Instructional Materials That Work

Examples of What Works in Academic and Vocational Integration

Samuel Halperin of the William T. Grant Foundation Commission of Youth and America's Future states in the introduction to *Hands and Minds Redefining Success in Vocational Technical Education*:

> Cooperative learning, team teaching, viewing students as responsible and productive workers, "hands-on" or experiential learning, individually-paced instruction, performance-based assessment, close linkages between employers and schools have long been essential features of good vocational education. Today, those concepts and practices may properly be viewed as universally applicable to all instruction and all students. Based on years of cognitive research and millions of dollars invested in curriculum development, we now have validation of the old observation that "the way to students' minds is through their hands." (Halperin, 1992, p. i)

Indeed, as several of these case studies suggest, well-prepared vocational technical education students can outperform their peers in the "general track" and may challenge the traditional "college track" on standardized tests of academic subject matter.

Cases with Promise

In *The Case for Integrating Academic and Vocational Education*, Adelman (1989) examines five different programs that have been in existence long enough to provide feedback on effectiveness. A synopsis of four of the five programs which appeared to be successful and promising are described below:

New York State Occupational Education Division

The division assumed the entire responsibility for revising the 7th through 9th grade occupational education curriculum to include much greater emphasis on technology literacy and practical application of academic skills. The plan was based upon the following assumptions:

1. Curricula be packaged in small units or modules that are easily revised or replaced.

2. All students in occupational education could take a set of core competencies related to personal development, social systems, information systems, resource management, and technology.

3. These core competencies should be taught in a manner that cross-cuts all specific occupational programs.

The curriculum evolved into the following:

Grades 7 & 8—Home and career skills (3/4 unit required by end of 8th grade): emphasizing decision-making, problem-solving, management, personal development, career planning. Introduction to Technology (one unit required by end of 8th grade): 10 modules emphasizing technological systems, mathematics and science concepts, societal implications of technology, communication skills, safety and health, psychomotor skills, creative problem-solving, and transfer of learning to new problem situations.

Grades 9 & 10—Introduction to Occupations (one unit required of all students planning an occupational education sequence to meet graduation requirements: includes two required modules (Personal Resource Management and Working Citizen) with an additional two modules to be selected by the school or specific occupational program from among a total of 24 developed modules. Modules incorporate competencies in math/science/communications/problem-solving, use of technology, and human relations/leadership.

Major concepts to be developed in the required junior high school course in technology and in the 9th grade course called "Introduction to Occupations" include:

- Formalized methods (systems) used to solve technological problems or make technological decisions.

- The problem-solving process includes design (planning) and implementation.

- An important part of the problem-solving process involves the generation of alternatives and the search for an optimal solution.

- Optimization of a solution normally requires trade-offs, in order to best meet the specified design criteria.
- Modeling techniques (e.g., drawings, computer simulations, working models, etc.) are useful problem-solving aids.
- Some problems cannot be solved by technology because of constraints imposed by scientific principles, resource limitations, and/or constraints resulting from people's values and attitudes.

All modules emphasize a hands-on approach through projects such as construction of model rockets.

Results: Plans are under way to have state-developed vocational specialty tests for program completers, including both written and performance testing or laboratory evaluation components.

Ohio State Vocational Education Program

This program authorizes various combinations of vocational and academic instruction tied to variable levels of state funding and requires a minimum of three hours per day of vocational shop or lab. Configurations differ primarily depending upon whether the vocational teacher handles the academic components as well as the vocational, or in amount of time students spend in classes taught by subject specialists. One specific example was cited—Montgomery County Joint Vocational School (JVS) in Dayton, Ohio—where 28 of the school's 49 vocational programs require students to take one or more applied communications, math, or science courses taught by academically certified teachers. Academic and vocational teachers are required to work closely together. Vocational teachers remain in the classroom with the academic teachers, often team teaching. Academic teachers are strongly encouraged (not required) to spend time observing in the vocational classroom and at actual worksites.

Results: Achievement test scores in reading and mathematics for students in the auto body program moved from far below average to close to the median. Scores for welding students moved from the mid-range to the top quartile. The JVS emphasizes a developmental writing program for all students. Each student is assigned 18 writing tasks each semester, including four essays. In recent years, on the average, students improved approximately three-fourths of a point in the junior year and a full point in the senior year.

Health Academy of Oakland Technical High School

This is a school-within-a-school model. The School specifically targets at-risk, disadvantaged, underachieving students (potential dropouts). The program is characterized as: (1) strong business/industry involvement, (2) a family environment fostered by block-scheduling that keeps a group of students together throughout most of the school day, and (3) opportunities for work experience that clarify the relationship between school work and real work.

Oakland Technical High School's Health Academy is an intensive, college preparatory academic/technical program with an applied emphasis. One hundred fifty students are accommodated in grades 10-12. Nearly all accepted have failed two or more subjects in the 9th grade. Rather than "dumbing-down" the curriculum for these at-risk students, expectations are accelerated. Academy students take an additional mathematics unit, four additional units in science, and a half unit of computer education. In their senior year, students are eligible to participate in an advanced health occupations course offered jointly by the Health Academy/the Regional Occupational Program and Kaiser Hospital. This course requires one semester of academic training in laboratory, computer, and medical terminology and one semester of rotating, short-term internships in different departments of the hospital.

None of the faculty relied on textbooks, rather they used overhead transparencies, worksheets, group discussion exercises, and occasionally bits and pieces of commercially produced material excerpted from a wide variety of sources. Required science courses include biology/physiology, and chemistry. Some students may take physics or advanced courses at a college or university. Additional lab periods are scheduled for required science courses. Most students complete pre-algebra, algebra, and geometry, each taught with emphasis on applications to the health occupations. Capable students are encouraged to pursue higher math.

Results: Of the 42 students who entered in 1985, 20 went on to the University of California at Berkeley or at Davis, 12 others planned to attend local community colleges, and seven took full-time jobs. One student failed to graduate.

Harrisburg, Pennsylvania, Dauphin County Technical School

This is a comprehensive area vocational school. Students receive all their vocational and academic credits at the school. Eight hundred (800) students are enrolled in grades 10-12. The school has eliminated the traditional departmental structure in all areas of study and reorganized the faculty into four occupational clusters: technical careers, service careers, construction careers, and communication and transportation careers. Academic teachers are assigned to specific clusters and work exclusively with students in that career cluster. The school uses a week-on/week-off structure, students concentrate on the academics one week and the vocational/technical content the next. The school's vocational programs have been competency-based. Academic course work has been competency-based as well.

The social studies curriculum emphasizes the historical impact of work, workers, and industrial/technical advances, in addition to a good deal of emphasis on employability and independent living skills. The math curriculum is completely integrated into the technical subject matter. Improved integration of the Sciences is a goal for the school. The English classes concentrate on technical report writing. Students are required to complete a technical paper about a shop or lab procedure that ultimately includes: a cover page, an outline of contents, an information sheet (the body of the paper), a glossary, and a quiz based on the material presented. The better papers find their way into the curriculum for the use of other students.

The integrated competency-based curriculum was developed in-house. Instructors drew upon a variety of texts rather than a single series in an effort to identify problems and examples with the highest relevance for students vocational interests.

Results: This program has been extended from a five year plan to a 10 year plan. Pre- and post-testing for incoming sophomores and exiting seniors, using an instrument called the 3-R's test, found improved math scores but a decline in the language arts areas.

Most of the pilot sites in the Southern Regional Education Consortium use applied programs. Students who normally would not have taken advanced mathematics or science classes have been able to pursue successfully this higher-level content. Several of the sites examined for this document used the applied physics curriculum called Principles of Technology (PT), developed by the Texas-based Center for Occupational Research and Development (CORD). PT is a rigorous

two-year course of study that includes 14 units of instruction, each devoted to one physical principle as it applies to the four energy systems: mechanical, fluid, thermal and electrical. Teachers who use PT report that it provides dynamic opportunities for students.

Incentives

So far, nationally, the burden for bringing change, to integrating instruction, has fallen upon vocational education instructors. In most sites, academic and vocational teachers continue to teach their subject. Success comes primarily due to sensitivity that exists between the academic and the vocational instructors. Different sites have attacked this problem in different ways:

- establishment of mechanisms for regular meetings between academic and vocational teachers.
- roundtables
- cluster meetings to model the idea of quality circles in business and industry
- forums to discuss issues and problems
- nearly all programs encourage teachers to observe in each others classrooms, and visit in work settings

Leaders encourage teachers to implement integration in several ways: self-constructed professional development programs, stipends for those who accept special responsibilities, release time for planning and curricula development, and generous measures of understanding to counteract apprehensions and frustrations.

Success Factors

Teacher Selection: Greatest success seems to come where teachers have been carefully selected and treated as special, and where leaders spend time, energy and personal money to encourage people to work together. There also appears to be some relationship between teacher expectations and student performance. Where expectations are highest, performance is highest.

Leadership: Some success can be attributed to the actions of a "glue person", someone who takes responsibility for making things work, for ironing out difficulties, making arrangements, getting assistance, and generally serving as the program's committed advocate. Each program has someone serving this purpose. Success of the program can be attributed, at least in part, to the effectiveness of this person.

Organization: A "school-within-a school" concept appears to work best at increasing success rates of at-risk students in large comprehensive high schools.

Effective Teaching Methodology: Adelman reports that two major practices emerged. First, teachers were actually engaged in an instructional dialogue with students. It was sufficiently different from either a lecture format or from routine seat work to be striking. Second, either by instinct or professional development training, teachers were using probes and questions that caused students to reflect, to draw on previous knowledge, and to ask questions of their own.

Examples of vocational and academic teachers successfully working together in developing interdisciplinary curricula are becoming more common than they were a few years ago. In a project which involved a high school in St. Paul, Minnesota, and a high school in New Richmond, Wisconsin, communication among participants led them to see possibilities in their subjects they had never considered (Beck et al., 1991). To connect disciplines, academic and vocational teachers, administrators, and counselors got better acquainted as professionals and began to develop interdisciplinary curricular interventions for the fall term through participation in summer training workshops. Participants were encouraged to follow an action research strategy and complete statements such as:

- I would like to improve_____.
- Some students are unhappy about_____.
- I am perplexed by_____.
- A source of irritation is_____.
- An idea I would like to try is_____.

Each school worked with its strengths. At New Richmond, biology and agriculture teachers exchanged classrooms and students for one week. The

agriculture students studied cross culturing and discussed ethical issues and economic considerations of biotechnology while in class with the biology teacher. The biology students studied water quality with the agriculture teacher. They used "hands-on, minds-on" learning methods typical in the vocational classroom. They visited a watershed, hosted a team of university groundwater experts, and discussed controversial local issues such as local companies discharging dangerous wastes into their river.

As a result of the week the teachers spent working together and exchanging experiences, they decided to break down the wall between the departments. The teachers spearheaded two new initiatives: a new agriculture/science curriculum in a new greenhouse, and a K-12 environmental education program.

At Humboldt in St. Paul, Minnesota the industrial technology teacher used an active outreach strategy to interest and help teachers and students who were unfamiliar with the graphic arts curriculum. The industrial technology teacher asked college prep English and geometry teachers to bring their students into the Macintosh computer laboratory to be peer-tutored by the graphic arts students. While there was great success with the English students; the geometry students lacked the prerequisite readiness to use the laboratory. The individual teachers decided that they would adapt their strategy and provide more preparation time for students to use the laboratory.

In an entrepreneurship related activity, two classes at New Richmond High School correlated their curriculum by conducting a joint feasibility study for a Frisbee golf course. The applied mathematics teacher and the business management teacher teamed their classes to study the potential of a Frisbee golf course for providing needed recreational outlets for high school students in the community. Their unit emphasized statistical applications and analysis. Students collected two types of data. They gathered data for different distances and angles for the Frisbee course and effects of student characteristics such as handedness, age, and grade level. They also conducted market research with fellow students. The students entered the data into the database and graphing functions of their program. With the computer as the center of the project, mathematics students learned the statistical concepts and the business management students analyzed the results. The final products were videotaped impact statements and a joint decision NOT to build a Frisbee golf course. Students elaborated on the amount of planning required to go into a new business.

At Humbolt, a teaching team from general mathematics/science and home economics developed a correlated curriculum to study world protein distribution. The teachers wanted their students to learn more about percentages in mathematics, the protein content in meats, and the protein distribution throughout the world's population. The teachers mixed their students, shared their traditional teaching space (the mini-auditorium and the foods laboratory), and shared resources (food, beakers, scales, microwave ovens). The teachers became aware of the potential for developing a fused food science course to provide training for the students who become employed in the food science industry after graduation in the Humboldt area. Teachers also began to see the value that other curricular areas could bring to the collaboration. The overall feeling of the teachers involved was that through simple modest collaboration of academic and vocational teachers, complexity can follow in a naturally stepwise fashion (Beck et al., 1991).

Another example of academic and vocational integration involved a core curriculum approach to instruction using a case study for problem-solving and a nine-week grading period for the project. The disciplines involved were economics, wood technology, and family and consumer economics. The case problem involved a family business that was losing market share to cheap imported furniture. The students researched, developed, produced, and marketed a new line of locker shelves as a way to save the company. Teachers acted as business consultants, helping the students deal with such problems as compensation, equity, performance review, risk-taking, and cooperation. At the end of their nine-week project all participants realized that the real world of work contains many challenges. A major benefit of the project came from the participation of all students in the project. One teacher commented that some of the student leaders in this project who were perceived to be the "outlaws" in the school performed responsibly and with enthusiasm in the core leadership team role (Beck et al., 1991).

Instructional Materials That Work

In the publication *Hands and Minds: Redefining Success in Vocational Education* (Halperin,1992), the instructional materials produced by CORD are discussed. The Center for Occupational Research and Development (CORD) in Waco, Texas, has developed coursework that blends basic academic knowledge with workplace realities, emphasizing a hands-on, applications-based approach to learning. The materials were developed through consortia of state vocational agencies and in collaboration with educators and employers nationwide and in Canada. Among the courses are:

- Principles of Technology—the principles and applications of physics in the workplace.

- Applied Mathematics—arithmetic, algebra, geometry, right-angle trigonometry, probability, and statistics in the context of workplace problems.

- Applied Communications—the practical essentials of writing, speaking, communicating, and working with people in the workplace environment. (This course was developed by the Agency for Instructional Technology in Bloomington, Ind.)

- Applied Biology/Chemistry—blends and presents the two disciplines in the context of work environments. (p. 22)

Materials which focus on academic and vocational integration are currently being developed in many schools by teams of teachers dedicated to improving learning across the curriculum. State instructional curriculum laboratories and consortia are also developing and publishing materials that provide concrete examples to be applied in specific academic subject areas and in vocational areas. Textbook publishers, too, are beginning to offer many options in textbooks and materials which facilitate academic and vocational integration of the curriculum. The examples of materials becoming readily available to assist teachers in academic and vocational integration are far more extensive and focused than they were in the 1980s; the need for materials and ideas continues to grow.

The National Center for Research in Vocational Education has several research projects which are currently addressing issues related to academic and vocational education research. The major NCRVE research projects and principal investigators are identified in Appendix A. The research being conducted through the NCRVE reinforces the need for continuing development of instructional materials for academic and vocational integration.

Contacts for Academic and Vocational Integration Practices

Contacts for Academic and Vocational Integration Practices

The following examples and contacts for improving the academic achievement of general and vocational students come from thumbnail sketches of outstanding practices that were identified by the SREB in an October, 1991 paper.

A Study of What Works in Integrating Academic and Vocational Education

This study reports outcomes of interviews completed at three SREB-Vocational Education Consortium pilot sites to determine strategies that assist and harm high school vocational and academic teachers working together. Statements from the thirty interviews were recorded in four categories: Instructional strategies, curricular strategies, cooperative efforts, and administrative practices and procedures. The researchers recorded 129 positive statements and 86 negative statements in the study.

Contact:
Dr. B. June Schmidt, Professor and Principal Investigator
National Center for Research in Vocational Education
Virginia Polytechnic Institute and State University
Division of Vocational and Technical Education
Blacksburg, VA 24061-0254
703-231-8182

Note: See Appendix B

What United Career Center Did to Improve Academic Competencies of Students Completing Vocational Programs

In addition to increasing the reinforcement of mathematics in vocational courses, the United Career Center of Clarksburg, West Virginia, is offering trigonometry and English courses to its vocational students to help raise their achievement in mathematics and English. Some teachers have also integrated selected modules from principles of technology into their vocational courses. Middle school teachers in language arts, mathematics, and science are developing team-teaching units to help students see the connections between academic and vocational studies.

Contact:
Dr. Roy Thomas, Director of Research Coordinating Unit
West Virginia Department of Education, Research Coordinating Unit
Marshall University
307 Old Main
Huntington, WV 25701
304-696-2469

What Humphreys County Did to Improve Academic Competencies of Vocational Students Between 1988 and 1990

Humphreys County shifted from a six to a seven period day, adding more flexibility to scheduling classes, and has added to the vocational center a language arts teacher and a combined math and science teacher who taught the applied academic courses and assisted the vocational teachers in integrating related academic content into their curricula. In addition, each eighth grade student has also developed a four year plan to focus on the student's career goals.

Contact:
Don McNelly, Education Professor
Technology and Adult Education
University of Tennessee
402 Claxton Addition
Knoxville, TN 37996-3400
615-974-2574

Case Study Report of What Trigg County Did to Improve Academic Competencies of Vocational Students Between 1988 and 1990

A major emphasis on staff development activities involved academic and vocational teachers planning and reviewing curriculum, working together to define academic concepts, team teaching, learning about career planning, and discussing programs. The frequent joint activities improved faculty unity and mutual respect for programs. Parent involvement, an expanded tutoring program, higher expectations of students, more time on homework, a positive school climate for innovation, and financial support from the Board of Education contributed to Trigg County's success. During the first two years of the Consortium project, Trigg County High School significantly raised science and reading scores of students.

Contact:
Charlotte Tulloch and Joyce Logan, Teacher Educators
Department of Vocational Education
College of Education
University of Kentucky
Lexington, KY 40506
606-257-4272 or 606-257-5625

Integrating Principles of Technology into Trade and Technical Courses Area Vocational Tech Center

Central Vo-Tech in Drumright, Oklahoma, has implemented the Principles of Technology course to enhance students' technical training in the following programs: Auto Mechanics, Commercial Electricity, Electronics, Electronic Field Service Technology, and Industrial Technology Automation. The vocational classes have become high tech and require more extensive skills in the science and math areas. The Principles of Technology course and lab was established so that students could visit it as a separate class. The course teaches them basic concepts and principles from physics and improves their problem-solving and trouble-shooting skills. Students have the opportunity to actually apply what they study to their programs daily. This strategy allows students to understand that principles in math and science are as important and essential as employability skills. This Principles of Technology course has also been successful with students identified as being at risk of dropping out. Although these students are given high expectations, they have been successful in doing the difficult math calculations in the "hands-on" labs of the Principles of Technology course.

Contact:
Robin Carny, Instructor, Principles of Technology
Central Vo-Tech
3 CT Circle
Drumright, OK 74030
918-352-2551, Ext. 286

Eliminating Tracking in the English Curriculum

York High School's Technical English curriculum has raised expectations by eliminating tracking, using "Reading to Learn" strategies, and incorporating cooperative learning techniques. The Technical English program involves the same literature as in the college prep program, but uses a sociological and

expository approach rather than the literary criticism approach. In the Technical Writing course, students papers often have a career focus although they are required to do some writing based on literary classics. A resource period for at-risk students, an interdisciplinary team, and a computer writing lab are innovations and additions which will help reach the goal of raising expectations of all students.

Contact:
Florence B. Rush, Chairperson of English Department
York High School
York County School Board
302 Dare Road
Grafton, VA 23692
804-898-0354

Joint Learning Project
Between Senior English and Vocational Teachers for All Students:
What Was Required? Did It Work? What Were the Results?

Teachers at a vocational high school in Delaware have used the Senior Project, an exhibition of achievement, to incorporate student-centered research with the development of a career-related product and a final public presentation.

Contact:
David Lutz, Instructor, Cabinetmaking
Member of Senior Project Committee
Paul D. Hodgson High School
2527 Summit Bridge Rd.
Newark, DE 19702
302-834-0990

Incorporating Higher Level Mathematics in Students'
Four-Year Plans of Study

Students in the Tech Prep Program in St. Mary's County, Maryland, follow a four-year plan of study which includes higher level mathematics. General mathematics courses are not an option in the sequence. Students select a career cluster from business/management, engineering/mechanics, or health/human services; each cluster includes a particular sequence of mathematics appropriate to the career field.

Contact:
John Ryan, Director of Instruction
St. Mary's County Public Schools
Loveville, MD 20656
301-475-5511

Improving Communication and Curriculum Coordination Between High School Academic Teachers and Vocational Teachers at an Area Vocational Center

Lafayette Parish established strong communication and coordination between high school academic and vocational teachers at the local career center by providing an inter-school visitation program between the two groups of teachers. The process was initiated when vocational teachers hosted an all day in-service program at the vocational center for all teachers from one high school.

Contact:
Burnell LeJeune
Lafayette Parish School Board
P.O. Drawer 2158
Lafayette, LA 70502
318-236-6891, Ext. 291

Accelerating Student Learning by Eliminating the General Track

The administrators at Wheeling Park High School have created an atmosphere conducive for comprehensive high school faculty to work toward the SREB Consortium's goals. The successful strategies that contributed to school wide change include redesigning the vocational curriculum from the traditional block schedule to a modular reconfiguration.

Contact:
Chris Carder
Wheeling Park High School
Park View Road
Wheeling, WV 26003
304-243-0400 or 243-0413

Using What Was Learned from Teaching Applied Academic Courses to Revise the Academic and Vocational Curriculum for Grades 9-12

Administrators and faculty at Fairdale High School implemented applied courses on an experimental basis at the tenth-grade level during the 1988-89 school year. From 1989-1991, they looked at what worked in the applied courses and utilized strategies to revise both academic and vocational courses for grades 9-12.

Contact:
Eileen Dalenberg
Jefferson County Schools
Durrett Education Center
1001 Fairdale Road
Fairdale, KY 40118
502-473-8248

Strategies Used to Accelerate Student Learning

One of many strategies used at Swansea High School is the establishment of an "idea center" to encourage academic and vocational teachers to share instructional practices. The high school has one large bulletin board reserved for each teacher to post regularly a summary of the subject areas they will address as their classes progress from one instructional unit to the next. After posting a summary, each teacher looks at the summaries of other teachers to identify the cross-curricular connections that could be made. Teachers then offer assistance or lend materials to each other.

Contact:
Sandy Sarvis
Swansea High School
P.O. Box 569
Swansea, SC 29160
803-568-3886

Implementing a Four-Year Educational Plan and Involving Parents in the Process

At the Pontotoc Area Vocational Center parents, the counselor from the vo-tech, and counselors from the two high schools meet annually with students to develop and review the four-year plan so that it can be adjusted as needed.

Contact:
Phil Flynn, Counselor
Pontotoc Ridge Area Vocational Center
354 Center Ridge Drive
Pontotoc, MS 38863-1299
601-489-1826

Getting Male Students to Read Technical Materials

Teachers in Randolph County are encouraging males students to read technical materials through using a variety of strategies including a cooperative learning strategy called "Jigsaw," a research strategy called "Whatchamacallit," an end-of-period process called Inquisitive Question, and high interest reading assignments pertaining to content areas in magazines such as *Hot Rod* or *Road and Track*.

Contact:
Paula Heinke
Randolph County Vocational Technical Center
Route #3, Box 246
Elkins, WV 26241
304-636-9195

Advancing Reading, Writing, and Analytical Skills Through International Marketing

This teacher of international marketing has been using various strategies to advance the reading, writing, and analytical skills. She emphasizes a series of student projects that deal with understanding economics and marketing in the global context. The results have also helped to bring a mainstream group of students into the marketing program.

Contact:
Gina Bottoms, Marketing Teacher
McLean High School
1633 Davidson Road
McLean, VA
703-532-6480

What We Have Done and Plan to Do to Revise Academic and Vocational Curriculum to Accelerate Academic Competencies of General And Vocational Students

Apopka High School has dramatically reduced the number of courses in mathematics below the pre-algebra level from 26 to 13. Plans are to eliminate all low level courses in mathematics. All lower level courses now contain applied strategies and concepts from algebra and geometry. Likewise, Apopka has eliminated the lowest level English and science courses and has committed to eliminate all low level courses in those areas. Apopka's staff has also planned a program of studies that links applied courses with a career cluster.

Contact:
Joseph Joyner, Principal
Apopka Senior High School
555 West Martin Street
Apopka, FL 32703
407-889-4194, Ext. 227

A New Lease on Teaching-Integrating Academic and Vocational Education

Swain County High School has implemented a team teaching strategy that works for students. After receiving staff development in team teaching, four academic and three vocational teachers designed teaching units, set up labs, and are currently using the team teaching approach in the following areas: Applied Biology-Chemistry and Health Occupations; Technical Math and Auto Technology; and Applied Communications and Keyboarding.

Contact:
Janet Clapsaddle, Applied Biology Chemistry Teacher
Joan Thomas, Health Occupations Teacher
Kate Welch, Business Teacher
Anne Watkins, Principles of Technology Teacher
Swain County High School
P. O. Drawer FF
Bryson City, NC 28713
704-488-2152

Using the Academy Concept to Integrate Academic and Vocational Education for At-Risk Students

A team of academic and vocational teachers at Myers Park, North Carolina, are working together to integrate their curriculum and instructional program. They have found time to meet, used community resources, and provided support and encouragement for a group of students who have been selected as being most likely not to finish high school. A Business Academy and an Academy for Home and Health Science have been organized for the health occupations and commercial food services programs.

Contact:
Gwen Willis, Curriculum Specialist for Vocational Education
Myers Park High School
Charlotte-Meckleburg School System
P. O. Box 30035
Charlotte, NC 28230
704-379-7176

Putting "Beef" into the Academic and Vocational Curriculum at Greene County High School

The principal of Greene Central High School has bridged the gap between its academic and vocational teachers by developing teams of teachers and providing common planning time for each team. The teams have identified common content areas and have developed ways to support each other in the classroom. The process has facilitated other efforts such as eliminating general math and consumer math and focusing on relevance of content in the classroom.

Contact:
John W. Mew, Principal
Greene Central High School
Route 1, Box 11
Snow Hill, NC 28580
919-747-3814

Woodward High School Changes Its Mathematics and Science Curriculums and Instructional Process

By eliminating general mathematics and science, moving from a six to seven period day, increasing graduation requirements in mathematics from two to three units, and adding applied courses, Woodward High School has improved student achievement and decreased student failure and dropout rates.

Contact:
Tom Fisher, Mathematics Teacher
Woodward High School
P.O. Box E
Woodward, OK 73801
405-256-5329

Getting Students to Read for Learning in Academic and Vocational Classes

In the only pilot site where black students have higher achievement scores in reading than do white students, teachers in Norfolk are using "Reading for Learning"" strategies in all classrooms. These strategies involve shifting to a student-centered approach to learning. The central office has followed up staff development in "Reading for Learning" with strong encouragement to teachers to practice what they learn.

Contact:
Ann Edney-Pyle, English Teacher
Dorothy Valencia, Biology Teacher
Claude H. Sawyer, Principal
Norview High School
Middleton Place
Norfolk Vo-Technical Center
1330 N. Military
Norfolk, VA 23502
804-441-5625

Teaching Chemistry through Industrial Application

A teacher from Memphis has developed an Industrial Chemistry program that provides students with specialty training in chemical analysis and quality control techniques using scientific apparatus and instrumentation. This training enables students to work in the chemical industry immediately after high school. The program also provides basic chemistry, mathematics, computer, reading, and research training necessary for pursuing higher degrees in chemistry or chemical engineering technologies.

Contact:
Diane Jernigan, Industrial Chemistry Teacher
Trezevant Vocational-Technical Center
Department of Secondary Schools
2300 Hernado Road
Memphis, TN 38106
901-357-3800

Teaching Mathematics and Communications through an Entrepreneurship Academy

The Florida Education Center's Academy of Entrepreneurship is designed for students with an expressed interest in owning and operating a small business. The intensive program of study includes higher level mathematics and communication skills and problem-solving.

Contact:
Loretta Cordell, Program Director
Florida Education Center
Department of Education
Tallahassee, FL 32399
904-487-3140

Joint Effort by Gulf Coast Community College and Bay School District to Improve Academic Preparation of General and Vocational Students

A committee of 25 teachers representing high schools in Bay County and professors at Gulf Coast Community College conducted a content analysis of the high school Course Student Performance Standards (CSPS) compared to the College-Level Academic Skills Test (CLAST) developed in Florida. Through the

comparison, the background of Algebra I, Algebra II, and Geometry would enable high school graduates to succeed in a college-level mathematics course.

Contact:
Dr. Linda Adaire, Vice-President for Instructional Services
Gulf Coast Community College
5230 West Highway 98
Panama City, FL 32401
904-872-3805
Mrs. Glenda Hamby, Assistant Superintendent for Instructional Services
Bay County Schools
P. O. Drawer 820
Panama City, FL 32402
904-872-4351

Using Consortium Strategies to Revise High School Curriculum and Instruction for General and Vocational Students

Academic and vocational teachers at Woodlawn High School have worked together to revise both academic and vocational courses and the instructional process. The Applied Mathematics teachers and vocational teachers have worked most closely to share equipment and applications of mathematics. Students have also been provided with a special tutoring program in mathematics that has worked well.

Contact:
Chris Strother, Principal
Woodlawn High School
7340 Wingate
Shreveport, LA 71106
318-686-3161

Nutrition Science--A New Home Economics Course

Tennessee has developed a new nutrition science course that provides a practical medium for the transfer of scientific concepts. The purpose of this course is to integrate science and nutrition curriculum and instruction. Course developers have provided teacher training needed to implement the course.

Contact:
Marie Freeman, Vocational Supervisor
Knox County Schools
P. O. Box 2188
Knoxville, TN 37901
615-521-2420

Integrating Applied Learning Strategies into a Revised Mathematics Curriculum

York High School has developed applications for and sources of realistic problems for every course in the mathematics curriculum, including a course written specifically to address applied strategies through the branch of mathematics known as management science.

Contact:
Linda Laity Hite, Chairperson
Mathematics Department
York High School
9300 George Washington Highway
Yorktown, VA 23692
804-898-0354

Helping Academic and Vocational Teachers Integrate Mathematics and Vocational Education

Six mathematics teachers and 15 vocational teachers at Cedartown High School worked together to pinpoint the mathematics skills needed for each vocational course. The vocational faculty developed a list of job-related examples to be used through applied learning methods in the mathematics classes.

Contact:
Radford Talley
Cedartown High School
Route 1, Frank Lott Drive
Cedartown, GA 30125
404-748-0499

Using the Tech Prep Approach to Replace the General Track

Walhalla High School is using Tech Prep to replace the general track. To accomplish his, general level courses have been replaced with applied courses, such as physics for the technologies, communications for the workplace, mathematics for the technologies, and applied biology and chemistry. Walhalla has also stopped the practice of assigning "the best teachers" to the highest track and has moved from a six-to seven-period day. A comprehensive career guidance program, "Project Destination," provides assistance from grades 6-12. In addition, Tri-County Technical College is currently working with the school system to develop courses so that graduates from the Tech Prep program will not repeat courses when they advance to the technical college.

Contact:
John Hostetler, Principal
Walhalla High School
Walhalla, SC 29691
803-638-4582

Hands and Minds (Education Writers' Association, 1992) cites the following school as an example of successful integration of academic and vocational education:

Health and Bioscience Academy

The Health and Bioscience Academy founded in 1985 is a school within a school at Oakland Technical High School. The academy is one of 10 sites funded by the National Youth Apprenticeship Initiative Jobs for the Future. The academy relies on team teaching and theming to link curriculum. For example, when students learn about hand-washing techniques in biology lab classes, they're assigned a short story on bacteria in English class, and the history lesson will focus on an epidemic. The 175 students in the academy are scheduled in blocks; students are given personal attention; experts are brought in to train students; students are taken on field trips which include areas beyond the health field; teachers have a common preparation period and function much as a team.

Other examples of academic and vocational integration include the following:

Clement G. McDonough City Magnet School, Lowell, Massachusetts (K-8)

The premise of programs at this school is that a connection needs to be made between school, work, and life in the early grades. The school is called a "micro-society school" which includes four "strands": citizenship/government, economy, science/high technology, and publishing. Students in grades K-3 are introduced to the school's program and in later grades take on more and more responsibility. Students at the school learn by such activities as running their own businesses, publishing companies and books. Students have "jobs" based on various placement test scores and teacher recommendations. Responsibilities progressively increase as students move into higher grades.

Florida's Blueprint for Career Preparation (K-12)

The *Blueprint* serves as a guide for preparing students to enter both post-secondary education and the workplace after graduation. The *Blueprint* includes specific goals for the various grade levels including the following broad goals (Florida Department of Education, 1991):

K-5—career development program includes self awareness, technology awareness, and career awareness; Grade 6—personal assessment and technological literacy program; Grades 7-8—goal identification, development of a four year Individualized Career Plan (for grades 9-12); Grades 9-12—students, parents, and guidance team annually review and update Individualized Career Plan; Grade 12—complete high school and enter post secondary education and/or the workforce with marketable skills and competencies identified in the workplace literature(e.g., SCANS).

Post-Secondary—education programs that will enable them to:

- successfully enter the world of work
- maintain competence in current employment
- advance in their occupational field
- change occupations

Florida's *Blueprint for Career Preparation* and school improvement initiatives are founded on a premise that education at all levels should involve parents, business/industry and the community in educating students.

In an article by Claus in 1989, he addressed recommendations for improving vocational programs in three categories: (1) those that concern classroom instruction directly, (2) those that address the preservice and in-service preparation of vocational instructors and administrators, and (3) those that attend to institutional-level support of what is desired in classrooms. The first recommendation is that problem solving, decision making, and analytical thinking be made an explicit part of instruction. The role of the teacher is to guide students in their experiential activities toward analysis, synthesis, and useful application of what has been learned. The change seems to be needed in changing to a focus on problem solving and reflective analysis, as well as the techniques of inquiry. The need to link basic skill instruction and vocational education has assisted in addressing skill deficiencies of students and increased the meaning and motivation of students to master material and tasks. The third recommendation related to classroom instruction involves making entrepreneurial projects and group management of projects an integral part of the curriculum. Evaluations of projects for "at-risk and disadvantaged" youth suggest that democratic entrepreneurial experience can be an effective way to improve the potential employability of these youth. Entrepreneurial projects not only prepare students to succeed in the system they face, but they encourage "critical thinking" and analysis of the system.

What is Needed for the Future?

Support

Staff Development

Roles of Individuals

Conclusions

What is Needed for the Future?

To put changes in vocational education into practice, it is critical that vocational teachers be prepared to teach the process of analytical thinking, problem solving and decision making. They also need to be prepared to teach the basic skills as part of their chosen vocational discipline. Vocational teachers will need to be trained in working as team members to integrate academic and vocational concepts across the curriculum. They should have a working knowledge of how to run a business in their own field. They should also be prepared to design and guide group management activities. Vocational instructors should be knowledgeable about the workplace organization, the social, economic, and political implications of career training and work in our society. In short, vocational instructors must be able to function as change agents in the school and for the workplace.

Support

The institutional level support and change needed for vocational education of the future will require that policy makers commit to providing vocational instructors with the time and resources necessary to prepare for and implement more academically integrated instruction. Strategies that encourage academic and vocational teaming, common planning periods, assistance by curriculum specialists, appropriately trained staff, and regular in-service and in-school planning time contribute to the improvement of vocational instructor training. Another area that requires administrative support is the area of accessibility of the program to students of all backgrounds. Typically the vocational programs have been encouraged only to lower or middle income students and to those who are below or average in intelligence.

Staff Development

Ideas for staff development generated by academic and vocational teachers involved in the integration of academic and vocational education include the following broad recommendations for the state of Florida:

1. Conduct three levels of integration workshops of 3-5 days in length during the summer of each year. These workshops would be aimed at academic and vocational instructional and support personnel. They should be located in northern, central, and southern sites.

2. Contract with one (or more) teacher educator or academic/vocational team of teacher educators from selected universities to provide staff development and technical services to LEA's within a region.

3. Conduct special one day workshops around the state targeted at specific key decision makers such as principals, directors, school board members, superintendents, etc.

4. Establish an Integrated Curriculum Consortium in which interested LEA's would jointly develop high quality print and non-print integrated curriculum materials which would be duplicated and shared among members.

Roles of Individuals

In looking at the roles of individuals in schools in the integration of academic and vocational education, teachers, administrators, support personnel, teacher-educators, and policymakers all have important roles. The following brief statements summarize some of the key roles of the various individuals:

Teachers

- Academic and vocational teachers collaborating
- Vocational teachers reinforcing academic skills and concepts
- Academic teachers using applied teaching strategies to make learning more interesting and effective
- Academic teachers using occupational examples to give relevance to academic skills and concepts

Administrators

- Administrators providing leadership, resources and a climate to facilitate integration
- Administrators becoming change agents in the restructuring of schools

Support Personnel

- Support personnel making necessary changes in support systems to facilitate integration
- Developing management systems to enhance and evaluate empowerment from the classroom through the school district

Teacher Educators

- Teacher educators modeling integration and collaboration
- Teacher educators preparing future teachers to successfully integrate academic and vocational education

Policy Makers

- Policy makers changing the system to allow and promote successful integration of academic and vocational education
- Policy makers developing strategies for empowerment of local schools

Conclusions

Changing the curriculum of schools to include opportunities for students to learn in the "context" of the world requires change in course content to allow the learning of theory and application to occur simultaneously. An example might be the English class that may write and publish a book that is illustrated by art and graphic arts processed by business, priced in math, and sold through marketing.

Academic and vocational integration must begin at the elementary level and be sequenced through educational experiences that move the individual from a beginning to advanced level. Emphasis in pedagogy must provide an emphasis on problem-solving, group and interactive learning, and real life products, projects and experiences.

Integration of academic and vocational education is not a quick fix for education. It is an improvement process. It is a process that requires concerted effort at all levels of education, including school, district, state and university. It is a process

which requires cooperation among all stakeholders in education—academic and vocational teachers, administrators, business, and university teacher educators.

Academic and vocational integration applies ideally to all students and must be planned for and implemented with vision and commitment, and the realization that complex reforms take substantial periods of time. Support for resources such as teacher preparation, release time, staff development, common planning, curriculum materials, improved career counseling, and quality vocational and academic offerings are critical to long-term achievement in academic and vocational integration.

The potential results and benefits of the integration of academic and vocational education hold great promise for all individuals. Anticipated results of present initiatives include collaboration among teachers and new excitement about teaching and learning, improvements in both academic and vocational teaching, and a more coherent curriculum.

By restructuring the school academic and vocational curriculum for all students, the curriculum will become connected across disciplines and naturally enhance the engagement of students in the learning process. In addition, curriculum integration strategies provide an environment for teamwork and support rather than isolation for teachers. While change is most critical at the middle and high school levels, integration activities should be infused in the elementary curriculum. Changes can result in the reduction of segregation and tracking of students and a true transition to opportunities for further education and the workplace.

This document has cited many examples of outstanding efforts in integrating academic and vocational education. Many of the efforts need to be replicated in our schools. Additional models of integration need to be developed, and strategies need to be implemented. As educators, we must realize that we share a common goal in the educational development of all students—those who are labeled "academic" as well as those who are labeled "vocational." Woodward (cited in Grubb et al., 1991) stated very eloquently the case for integration in the 1700s:

> *Hail to the skillful, cunning hand!*
> *Hail to the cultured mind!*
> *Contending for the world's command,*
> *Here let them be combined. (p. 5)*

Keeping this in mind, we must develop a new openness to change and become willing to think differently about how to structure and design a more appropriate and educationally sound program to assure students' success as they enter the workforce in the 21st Century. It is time for change to take place in American schools! Our children and their futures are depending on us.

References

References

Adelman, N. E. (1989). *The case for integrating academic and vocational education.* Washington, DC: Policy Studies Associates, Inc. for the National Assessment of Vocational Education, U.S. Department of Education.

Beck, R. H., Copa, G. H. & Pease, V. H. (1991). Vocational and academic teachers work together. *Educational Leadership, 47*(2), 29-31.

Bottoms, G. & Presson, A. (1992). *Making high schools work through integrating academic and vocational studies.* Southern Regional Education Board. Atlanta, GA.

Brock, W. E. (1992). A vision for education. *Vocational Education Journal, 67*(8), 20-22.

Carl D. Perkins Vocational and Applied Technology Education Act of 1990.

Claus, J. F. (1989). Renegotiating vocational instruction. *The Urban Review, 21*(4), 193-207.

Florida Department of Education. (1991). *Blueprint for career preparation.* Tallahassee, FL: Division of Vocational, Adult & Community Education.

Fogarty, R. (1991). Ten ways to integrate curriculum. *Educational Leadership, 49*(2), 61-65.

Grubb, W. N. (1991). The challenge to change. *Vocational Education Journal, 66*(2), 3-5.

Grubb, W. N. (1991). *The cunning hand, the cultured mind.* Berkeley, CA: National Center for Research in Vocational Education, University of California. (ERIC Document Reproduction Service No. ED 334 421)

Halperin, S. (1992). *Hands and minds: redefining success in vocational technical education.* Washington, DC: Education Writers Association and William T. Grant Foundation Commission on Youth and America's Future.

Hull, D. & Parnell, D. (1991). *Tech prep associate degree-A win/win experience.* Waco, TX: Center for Occupational Research and Development.

National Center for Research in Vocational Education. (1988). *Basics: Bridging academic and vocational skills, A guide to implementing academic and vocational education.* Columbus, OH: NCRVE, the Ohio State Unviersity.

National Center for Research in Vocational Education. (1992). Strategies for integrating academic and vocational education. *Professional Development Bulletin, 1*(2), Berkeley, CA: NCRVE, the Ohio State University.

Norton, R. E., King-Fitch, C. C. & Harrington, L. G. (1986). *Improving the basic skills of vocational-technical students: An administrator's guide.* Columbus, OH: The National Center for Research in Vocational Education, The Ohio State University. (ERIC Document Reproduction Service No. ED 266 264)

Owens, T. & McClure, L. (1989). *New developments in improving the integration of academic and vocational education.* Portland, OR: Northwest Regional Educational Laboratory. (ERIC Document Reproduction Service No. ED 314 841)

Pritz, S. G. & Crowe, M. R. (1987). *Techniques for joint effort: the vocational-academic approach.* Columbus, OH: The National Center for Research in Vocational Education, The Ohio State University. (ERIC Document Reproduction Service No. ED 288 960)

Pritz, S. G. & Davis, L. D. (1990). Getting down to basics. *Vocational Education Journal, 65*(8), 38-39.

Pritz, S. G. (1992). *The global view of vocational-academic integration.* Prepared for the Michigan Vocational-Technical Education Policy Issues Forum. (ERIC Document Reproduction Service No. ED 336 546)

Scaglione, J. B. (1992). Cooperative learning strategies in the business education curriculum. *Business Education Forum,* 15-17.

Schlechty, P. C. (1990). *Schools for the 21st century.* San Francisco, CA: Jossey-Bass.

Schmidt, J. B. (1992). *Collaborative efforts between vocational and academic teachers: Strategies that facilitate and hinder the efforts.* Berkeley, CA: University of California at Berkeley.

Secretary's Commission on Achieving Necessary Skills (SCANS). (1991). *What work requires of school.* Washington, DC: U.S. Department of Labor.

Southern Regional Education Board. (1991). *Outstanding practices for improving the academic achievement of general and vocational students.* Atlanta, GA: SREB.

Stasz, C. & Grubb, W. N. (1991). *Integrating academic and vocational education: guidelines for assessing a fuzzy reform.* Berkeley, CA: National Center for Research in Vocational Education. Report prepared for the National Assessment of Vocational Education, U. S. Department of Education.

Veach, J. P. and Crowe, M. R. (1987). *Primer for exemplary strategies.* Columbus, OH: The National Center for Research in Vocational Education, The Ohio State University. (ERIC Document Reproduction Service No. ED 288 956)

Appendices

Appendix A

Current Integration Research Projects—NCRVE

W. Norton Grubb, U.C. Berkeley, and Jane Plihal, U Minnesota,
Models of integration

Sue Bodilly, Cathy Stasz, and Jeannie Oakes, RAND
Policies related to implementation of integration efforts

Jerry Pepple, University of Illinois,
Applied academics programs: teacher attitudes, student outcomes

Judith Warren Little, U.C. Berkeley,
Cooperation between academic and vocational teachers

June Schmidt and Curtis Finch, Virginia Tech,
The role of vocational teachers in integration and implications for professional development

George Copa and Robert Beck, University of Minnesota,
Conceptual and philosophical aspects of integration

Appendix B
What Works in Academic and Vocational Education

Effective Curricular Strategies

- Revise the curriculum to eliminate the general track and develop study plans for all students accordingly.
- Have counselors, vocational teachers, and academic teachers work together to develop plans for all vocational offering—plans that prepare students for continued study at a four-year institution or in a postsecondary technical program in addition to immediate job-entry preparation.
- Have students adopt one of three plans—vocational, academic, or combined—as soon as possible, preferably by the time they enter ninth grade. The combined plan is not the old "general track," rather it provides both vocational and academic preparation.
- Provide teachers and counselors with examples showing them that in the past the policy of "no plan of study" locked students into "no future."
- Help academic teachers see the value of combining vocational and academic preparation. They will then be able to emphasize to their students the value of this preparation.
- Survey area employers to determine the use of technology and basic skills in various work settings; then use survey findings as a basis for changes in both vocational and academic offerings.
- Learn from employers which basic skills are needed on the job and then have vocational and academic teachers work together to stress them in their instruction.
- Learn from employers which basic skills are needed on the job and then have vocational and academic teachers work together to stress them in their instruction.
- Restructure general (basic academic) courses so that they become applied courses—courses that relate learning to the real world, so students can see the validity of what they are learning. Have vocational and academic teachers work together to develop instructional examples for applied offerings.
- Inform students of curricular changes and reasons for them. Students perceive teachers more positively when they learn that vocational and academic teachers are working together.

- Help academic teachers learn to rely less on text-based instruction and to rely more on vocational teachers as a resource for teaching real world applications.

- Emphasize importance of vocational and academic teachers relating their instruction to applied uses. This helps eliminate the problem of students having to tell their new employers that they have not learned even the most basic skills for the work setting.

- Update library holdings so that they support a revised, applied curriculum.

- Make remedial instruction readily available to students who need it, particularly to help them meet academic skill requirements for vocational offerings.

- Institute a daily reading period of fifteen to twenty minutes when all students and teachers drop everything and read whatever interests them, not homework assignments nor other class related materials.

- Have all teachers include basic skills objectives and instructional activities in their lesson plans and constantly evaluate attainment of the skills.

Effective Instructional Strategies

- Encourage teachers to have higher expectations for their students, particularly in their use of basic academic skills.
- Assign meaningful homework on a regular basis, including in vocational classes. Establish expectations that homework be completed.
- Develop coordinated instructional plans between vocational and academic teachers—plans that reinforce instructional objectives, strategies, and content in both areas.
- Have vocational teachers serve as guest speakers in academic classes to reinforce the need for what academic teachers are teaching.
- Use vocational student organization projects as a springboard for having vocational and academic teachers work together.
- Have vocational and academic teachers agree to reinforce the same basic academic skills for a particular period of time—for example, a grading period or several weeks.
- Have vocational and academic teachers develop cooperative assignments.
- Have academic teachers borrow equipment/supplies from vocational laboratories to illustrate actual math and science applications.
- Have vocational teachers incorporate academic skills in their day-to-day instruction, not try to teach students through drill/practice procedures.
- Have academic teachers prepare bulletin boards that illustrate vocational applications of skills taught in their classes and vice versa.
- Keep lists of academic skills that the vocational and academic teachers have agreed to emphasize on display in vocational classrooms.
- Have all students, vocational and academic provide both oral and written responses in complete sentences.
- Encourage vocational and academic teachers to compare what they are teaching in respect to basic academic competencies to assure that they are teaching the same things.
- Pretest students on basic academic skills needed to succeed in vocational classes, then offer remedial instruction only as needed.

- Provide vocational teachers with professional development activities so they can gain the expertise needed to teach basic academic skills.

- Provide professional development activities for achieving integration that focus on vocational and academic teachers when both types of teachers participate in the same activities.

- Establish procedures for academic teachers to follow when borrowing or using equipment from vocational teachers to assure proper use.

- Supply academic teachers with adequate equipment, tools, supplies, and training that supports the teaching of real-world applications of what students are learning.

- Provide opportunities for vocational and academic teachers to plan together in small groups, preferably in pairs, to facilitate exchange of information and to develop coordinated instruction. Further, establish procedures for evaluation of their cooperative efforts.

What Works in Academic and Vocational Integration

Effective Cooperative Efforts

- Have vocational teachers share projects that students complete in their classes with academic teachers. The projects can be used for further study in the academic classes.
- Provide time for academic teachers to observe and experience hands-on activities of ongoing instruction in vocational classes. Similarly, provide time for vocational teachers to observe ongoing instruction in academic classes.
- Encourage academic teachers to borrow books and other resource materials from vocational teachers and vice versa.
- Have vocational and academic teachers share, on a regular basis, competency lists, so they can learn the basic competencies the others teach or need students to know.
- Have teachers emphasize the same academic competencies and teach coordinated information about their use when vocational and academic teachers share students between their classes.
- Have academic teachers identify specific academic competencies they would like the vocational teachers to emphasize and vice versa.
- Provide extra time and incentives for vocational and academic teachers to work together, particularly when vocational teachers are located at vocational centers and have little regular contact with academic teachers.
- Assure that academic teachers feel they are part of the integration movement by involving them in the development of integration goals and objectives from the start.
- Emphasize to vocational teachers the complexity of learning and applying basic academic skills—skills that cannot be taught in isolation by academic teachers alone.
- Have vocational and academic teachers share class rolls, so they will know which of their students are in the others' classes.
- Eliminate the dichotomy that exists between vocational and academic programs by having teachers work together to focus on the needs of students, student that both vocational and academic teachers have in their classes.
- Provide adequate planning time for academic teachers to incorporate real-world examples in their instruction, planning time shared with vocational teachers.

What Works in Academic and Vocational Integration

Effective Administrative Practices and Procedures

- Establish a positive climate for the change process and involve all teachers.
- Help teachers develop ownership in the changes that are taking place by having them assume as many leadership responsibilities as possible.
- Publicize to the students, parents, and community the purposes and anticipated outcomes of the cooperative efforts being undertaken by the vocational and academic teachers.
- Let teachers know of administrative support for the changes in instruction through informal as well as formal channels of communication.
- Provide for staff development, with clearly defined outcome goals, that involves all vocational and academic teachers.
- Create a staff development environment that is free from distractions of the day-to-day routine of school operation.
- Divide teachers into small work groups when asking them to cooperate on various aspects of vocational and academic integration. Carefully assign teachers to the groups to facilitate positive outcomes.
- Provide open, unstructured time in a relaxed atmosphere for vocational and academic teachers to share.
- Provide incentives for teachers to be involved in planning and implementing innovative strategies for integrating vocational and academic education.
- Assure that guidance counselors are involved in all stages of the change process and that they support the concept of integration.
- Survey teachers, guidance counselors, and students to gain insight as to their perceptions and acceptance of the changes being undertaken.
- Have both vocational and academic teachers make time to ask students what they think they are learning and why.
- Review overall plans and strategies for achieving the integration of vocational and academic education with the teachers on a periodic basis—at least twice a year.
- Move classroom locations, whenever possible, of both vocational and academic teachers so that they will have more ready access to one another.

- When vocational offerings are provided at a vocational center, designate a teacher at the center and one at each feeder school as site coordinators for achieving integration
- Designate responsible students as carriers of information between the vocational center and the feeder schools to eliminate delays.
- Provide teachers, students, and public groups accurate information reflecting measurable outcomes of integration.
- Assure that all administrators display commitment to the concept of integration, not just vocational.
- Monitor professional development activities connected to outside sources to make sure they are meeting the needs of both vocational and academic teachers.
- Monitor planning and instruction of both vocational and academic teachers to assure that changes agreed upon to achieve the goals of integration are actually occurring.
- Update teacher evaluation procedures to reflect changes in teaching that occur due to the integration movement and increased emphasis on applied learning.
- Encourage uniform attendance and tardiness policies at both vocational centers and feeder schools.

Shmidt, B. J. (1992). *Collaborative Efforts Between Vocational and Academic Teachers: Strategies That Facilitate and Hinder The Efforts.* Berkeley, CA: National Center for Research in Vocational Education, University of California at Berkely.

Appendix C

Selected National Resources for Academic and VocationalCurriculum Integration

- The Center for Occupational Research and Development
  601 C Lake Air Drive
  Waco, Texas 76702-1689
  (800) 231-3015

- National Tech Prep Network
  C/O Center for Occupational Research and Development
  601 C Lake Air Drive
  Waco, Texas 76702-1689
  (800) 972-2766

- National Center for Research in Vocational Education (NCRVE)
  Materials Distribution Service
  Western Illinois University
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  Macomb, Illinois 61455
  (800) 637-7652

- National Network for Curriculum Coordination in Vocational Technical Education (NNCCVTE),
  South Curriculum Coordination Center,
  Research and Curriculum Unit
  P. O. Drawer DX
  Mississippi State, Mississippi 39762

- Southern Regional Education Board (SREB)
  592 Tenth St., N.W.
  Atlanta, GA 30318-5790
  (404) 875-9211

- Center for Applied Academics
  Northwest Regional Educational Laboratory
  101 S.W. Main St., Suite 500
  Portland, OR 97204
  (800) 547-6339 (Ext. 597)

- Agency for Instructional Technology
  Box A
  Bloomington, Indiana 47402
  (800) 457-4509

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